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The relevance of the Finnish hygiene passport test

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ABSTRACT

The Finnish Hygiene Passport System, a national legislative requirement, has been used to test the food safety knowledge of food handlers for almost 20 years, resulting in over one million approved hygiene passports. However, information on the relevance of the Hygiene Passport System is virtually nonexistent.

In order to evaluate the relevance of the official hygiene passport test, we collected a sample of original official hygiene passport tests from test examiners. We also arranged a simulated hygiene passport test for volunteers without any professional background in the food sector to investigate whether the basic level of hygiene knowledge of Finns is sufficient to pass the test.

Our study revealed that more than 80% of the participants in the official hygiene passport test passed. However, participants completing the test in a foreign language or with assistance had significantly more difficulties in passing the test. The results for the simulated test suggested that the food safety knowledge of most Finns would have enabled them to pass the official test without prior training, especially those older than 20 and with a higher educational level. The simulated test also revealed that preparation prior to the test, i.e. study or training, was effective in increasing the food safety knowledge of participants, especially when their knowledge level was initially low, as among young participants. Moreover, significant variation in the difficulty of the test itself was observed, which may affect the pass rate.

The current study supports the relevance of the hygiene passport test, showing that without the national requirement for the hygiene passport test, the level of food hygiene knowledge of new employees in the food sector, especially young people aged under 20, would be lower. However, our results suggest that the relevance of the hygiene passport test should be improved by validation of the test and by using official translations when conducting the test in a foreign language. Digitalization of the test would enable the regular evaluation of the test based on accurate data collection.

1. Introduction

The food safety legislation of the European Union pursues better food safety by obligating food business operators (FBOs) to ensure that their food handlers are supervised and instructed in food hygiene matters commensurate with their work activity (EC 852/2004, 2004). In Finland, the National Food Act (Ministry of Agriculture and Forestry of Finland, 2006) requires that those who in their work handle unpackaged and easily perishable foods in food premises shall confirm their hygiene proficiency with a hygiene passport at the latest after working for 3 months. Food enterprisers are responsible for ensuring that these requirements are fulfilled as regards their employees.

Hygiene knowledge certificates, cards, or passports for food handlers have been implemented at least in Malta (Anonymous, 2002), Portugal (Gomes-Neves et al., 2011), Romania (Jianu & Goleţ, 2014), and Canada (Anonymous, 1999). Some systems have different certificates intended for employees depending on the responsibilities and knowledge requirements of their duties. In many states of the USA, the food safety manager is required to be certified (Anonymous, 2021). In Luxembourg, an FBO starting a business in the hotel, restaurant, or catering sector is required to hold a Hotel & Catering business permit (The Luxembourg Ministry of the Economy, 2020).

The obligation to possess food hygiene knowledge in Finland has been applied since 1.1.2002 (Parliament of Finland, 1994). The aim has been to ensure that persons handling food are able to prevent food hygiene risks related to their activities. The requirement concerns employees working in shops, catering businesses, restaurants, the food industry, and meat, milk, fish, and egg establishments. It was initially

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assumed that the obligation would concern approximately 60,000 employees of the food sector. However, the popularity of official hygiene passports has been enormous; by the end of 2016, altogether 1,078,671 hygiene passports had been issued, with almost one in five Finns having a hygiene passport in 2016 (Finnish Food Safety Authority, 2017). Passing the official hygiene passport test is considered to promote employment to the food sector, even if the hygiene passport would not be obligatory due to the nature or temporality of the work. The cost of the test is paid either by the participant or the employer.

The Finnish Hygiene Passport System is directed by the Finnish Food Authority (FFA) (Ministry of Agriculture and Forestry of Finland, 2006). The official hygiene passport test may be performed under either regular (regular test) or special (special test) circumstances. The national requirements for the hygiene knowledge and skills of persons working in a food establishment are determined in detail in the order of hygiene proficiency (Finnish Food Authority, 2020). The test consists of the following subsections: 1) Basic microbiology and food contamination, 2) Food poisonings, 3) Hygienic working methods, 4) Personal hygiene, 5) Cleaning, 6) Own or in-house control and 7) Legislation, authorities. There are no requirements or recommendations concerning how the knowledge for the test should be acquired. FFA, as well as various private entities and hygiene passport examiners offer educational material containing information on the different areas of food hygiene. Hygiene courses are organized by entities and examiners. However, the material or hygiene courses are neither official nor approved. The passport is valid indefinitely.

The FFA annually publishes the number of test sessions and the number of approved (i.e. passed) tests. The operation of the hygiene passport system has stabilized at approximately 11,000 test sessions and 65,000 approved tests per year. However, data or scientific research focusing on the Finnish Hygiene Passport System, the level of performance of test participants, and the factors influencing performance is very limited. According to a study by Läikkö-Roto and Nevas (2014), restaurant business operators (RBOs) valued the passports more than local authorities. The researchers concluded that local authorities did not value the passports as highly as RBOs probably because authorities had experienced cases in which the hygiene passports had not led to adequate hygiene.

The aim of this study was i) to evaluate the level of performance of participants in the two types of official hygiene passport test, i.e. regular and special tests, and in different subsections of the test, and ii) to analyse the associations between background characteristics and the participants' performance. In order to provide a baseline for evaluation, Finns without experience in the food sector were recruited to a test that simulated the regular hygiene passport test. The simulated test allowed us iii) to examine the basic hygiene knowledge of laypersons and whether the test can be passed without any advance preparation.

2. Materials and methods

2.1. Official hygiene passport tests

Official hygiene passport tests are arranged under the authority of the FFA by hygiene passport examiners, who exert official authority when acting as examiners. The official hygiene passport test consists of 40 questions with binary statements. The examiner provides a unique test for each test session drawn from a question bank, comprising a pool of 1,214 statements concerning food hygiene (in 2016). The test is approved (i.e. passed) when at least 34 of 40 ($\geq$85%) statements have a correct answer. Tests are not electronic but conducted on paper.

There are two types of official hygiene passport test, which are performed under either regular (regular test) or special (special test) circumstances (Fig. 1). The regular test is performed in the official languages of Finland, i.e. Finnish or Swedish, and within a timeframe of 45 min (in 2016). In a special test, the test language is other than Finnish or Swedish, and the completion time for the test is unlimited. Swedish and English translations are the only official translations of the test, and the examiner is responsible for providing translations into all other languages or for arranging the use of an interpreter. In addition, a version of the test referred to as the 'simplified language' test is available, in which, depending on the circumstances needed, simple language is used in the statements, reading or verbal explanation of the statements is given, or some other personal assistance is provided. Those taking the simplified language test might have difficulties in reading, understanding or concentrating, or various disabilities. The simplified language test may be undertaken in Braille or sign language.

In order to investigate the performance of the participants in the official hygiene passport test, we collected official test forms in Southern Finland, where the population is the highest in Finland. Residential areas of different sizes were taken into account, as well as bilingual municipalities. Examiners working in different sectors were chosen, including a quality manager, a teacher, an advisor for the food sector, and private examiners. In autumn 2017, each selected examiner provided all the tests completed in 2016.

The official test form contains the name and date of birth of the participant, the participant's response to 40 statements, and the date

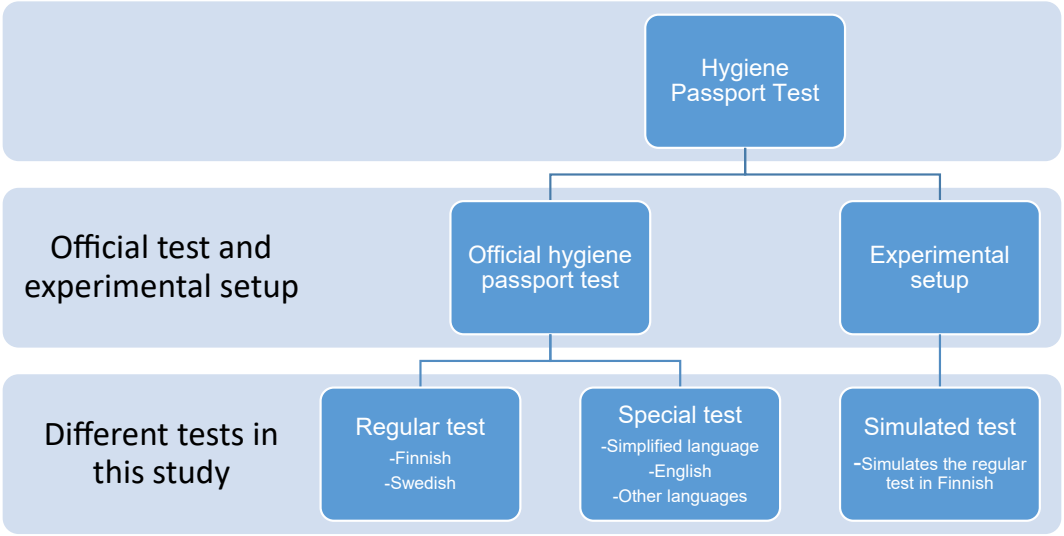

Fig. 1. The design of the different hygiene passport tests applied in the study.

and time of the test. The circumstances and the language of the test were mostly obtained from the documented information on the tests filed by the examiners; in 47 test cases, the information was traced in the IT system of the FFA. The gender of the participant was concluded from the name provided on the test form and was recorded as female, male, or not known. The age groups were categorized into five-year classes, except for the youngest participants, who were categorized as youths under the age of 16 years, who are undertaking their compulsory education in Finland, or as youths aged between 17 and 19 years.

A total of 3,647 official tests were collected, 2,980 of which were approved (i.e. passed). Information on the number of non-approved (i.e. failed) tests is not gathered by the competent authority. The collected sample of approved tests represented 4.90% of all approved tests in 2016 (Finnish Food Safety Authority, 2017). The collected tests were performed in 381 different test sessions, or 3.4% of all test sessions in 2016. In that year, the number of hygiene passport examiners in the whole Finland was more than 2,100. Hence, the examiners participating in our study (13) represented approximately 0.62% of the total.

The regular tests comprised approximately two-thirds of the collected official tests, with approximately one-third being special tests (Table 1). The great majority of the participants completed the official regular test in Finnish. The number of regular tests conducted in Swedish corresponded to the proportion of the Swedish-speaking population in Finland, i.e. 5.26% in 2016 (Statistics Finland, 2020).

The collected data were transferred to a spreadsheet in Microsoft® Excel® for Office 365. Tests in Finnish, Swedish, simplified language, and officially translated English tests were examined according to age groups. All the other tests performed in other languages with unofficial translations were examined together as one group. Two oldest special test groups, i.e. the age groups 46–55 and over 56 years, were combined to make the category large enough for statistical analysis.

Table 1
Pass rates of official (regular or special) test by participant characteristics.

Variable	Regular test		Special test	
	Number of participants		Number of participants	
	2562 (70.2% of total)		1085 (29.8% of total)	
	Participants	Passed the test	Participants	Passed the test
	N (%)	N (%)	N (%)	N (%)
	2562 (100)	2294 (89.5)	1085 (100)	686 (63.3)
Gender				
• Male	750 (29.3)	681 (90.8)	260 (24.0)	160 (61.5)
• Female	1707 (66.6)	1542 (90.3)	231 (21.3)	167 (72.3)
• Unknown	105 (4.1)	71 (67.6)	594 (54.7)	359 (60.4)
Age (years)				
• ≤16	397 (15.5)	323 (81.4)	20 (1.8)	13 (65)
• 17–19	677 (26.4)	609 (90)	57 (5.3)	39 (68.4)
• 20–25	474 (18.5)	445 (93.9)	198 (18.2)	139 (70.2)
• 26–35	301 (11.7)	271 (90)	418 (38.5)	254 (60.8)
• 36–45	272 (10.6)	242 (89)	270 (24.9)	165 (61.1)
• 46–55	285 (11.1)	259 (90.9)	110 (10.1)	68 (61.8)
• 56+	154 (6.0)	145 (94.2)	10 (0.9)	7 (70)
• Missing	2 (0.1)		2 (0.2)	
Language used in the test				
• Finnish	2408 (94)	2159 (89.7)		
• Swedish	154 (6)	135 (87.7)		
• Simplified language			222 (20.5)	109 (49.1)
• English			377 (34.7)	255 (67.6)
Other test languages, total			486 (44.8)	322 (66.3)
• Arabic			143 (13.2)	61 (42.7)
• Chinese			86 (7.9)	72 (83.7)
• Russian			79 (7.3)	65 (82.3)
• Thai			62 (7.3)	29 (46.8)
• Somali			32 (5.7)	30 (93.8)
• Estonian			26 (2.4)	23 (88.5)
• Spanish			11 (2.9)	5 (45.5)
• Farsi			10 (0.9)	3 (30)
• Polish			9 (0.8)	7 (77.8)
• Vietnamese			8 (0.7)	8 (100)
• Persian			7 (0.6)	7 (100)
• Nepali			5 (1.0)	4 (80.0)
• Italian			5 (0.5)	5 (100)
• Portuguese			3 (0.3)	3 (100)

2.2. Simulated hygiene passport tests and questionnaire

A simulated test was conducted in order to set the baseline of an layperson's food hygiene knowledge and assess whether the official hygiene passport test could be passed without training. The simulated test was shorter than the official test to save time and keep the volunteer participants motivated to complete the test. Simulated tests were formed by selecting ten official regular hygiene passport tests in Finnish from the question bank. From these, every other test was selected, comprising five tests altogether. Every other statement from each test was chosen, and the total of 20 statements in each of the five tests formed the five different simulated tests. Thus, the number of statements was half of that in an official test. However, the statements in the simulated test represented the different food hygiene knowledge subsections in the same proportion as in the official test. The simulated test was defined to be passed with 17 correct answers out of 20 statements (≥85%). The simulated test was administered by the market research company Taloustutkimus Oy through an Internet application and it was conducted online. The time allowed for the simulated test was not restricted.

Taloustutkimus Oy selected the participants from its own panel. Finnish-speaking citizens were reached evenly for both genders and ages between 15 and 65 years. All test persons were contacted by email. We hypothesized that the relative number of young people would be high among the participants in the official tests due to the importance of the hygiene passport for young job seekers. Thus, for the simulated test, more young people were reached by contacting the principals of upper secondary schools, high schools, and vocational schools around Finland. The teachers arranged the test situations according to the instructions provided by the researchers. The simulated test, which was arranged in autumn 2017, was completed via an electronic link using a mobile phone.

The test persons did not receive any prior information about the simulated test. The first questions excluded those who had already obtained the hygiene passport, who had received any kind of education in the food sector, or who had been working in food sector during the previous 20 years.

Test participants were asked questions concerning their personal background, household, cooking habits and skills, and whether they had ever suffered from suspected food poisoning (Table 2). The questions also concerned their trust in official authorities and companies in the food sector (Table 1, supplementary) and their attitudes towards food safety (Table 2, supplementary). The questionnaire on food safety attitudes was designed according to a food safety psychosocial questionnaire developed by Byrd-Bredbenner et al. (2007). Five food safety belief constructs were included: "interest in learning about avoiding food poisoning" (measured using a set of 4 statements), "importance of cleanliness/sanitation" (4 statements), "food poisoning susceptibility" (3 statements), "food poisoning is a threat" (2 statements), and "food poisoning is a personal threat" (3 statements) (Table 2, supplementary). Responses to the statements were provided on a four-point Likert scale (from opinion 1, strongly agree, to opinion 4, strongly disagree), with the additional possibility to answer "I don't know".

The simulated test and the questionnaire were completed by 1,329 persons.

2.3. Statistical analysis

The data were processed using SPSS statistical software (IBM SPSS Statistics 25, NY, USA). Univariate logistic regression analysis was used

Table 2
Background characteristics of the participants in the simulated hygiene passport test and the association with the probability of passing the test.

	N (% within the variable)	Passed (%)	Multiple explanatory variable regression analysis OR (95% CI), p
Number of participants, total	1329 (100)	72.6	
Variable			
Gender			
• Male *	703 (52.9)	75.7	
• Female	626 (47.1)	69.2	0.78 (0.60–1.01), 0.06
Age (years)			
• ≤16	86 (6.5)	36.0	0.29 (0.15–0.55), 0.000
• 17–19	115 (8.7)	40.0	0.34 (0.20–0.60), 0.000
• 20–25	90 (6.8)	71.1	0.88 (0.51–1.52), 0.648
• 26–35	241 (18.1)	77.2	0.95 (0.60–1.44), 0.80
• 36–45	234 (17.6)	82.9	1.37 (0.86–2.17), 0.19
• 46–55	265 (19.9)	81.1	1.22 (0.80–1.87), 0.36
• 56–65 *	298 (22.4)	76.8	
Education			1.23 (1.12–1.35), 0.000 per increase of one grade
• Elementary school	69 (5.2)	53.6	
• Vocational school or course	309 (23.3)	58.9	
• High school	205 (15.4)	68.8	
• Lower college degree	373 (28.1)	78.3	
• Higher college degree	43 (3.2)	83.7	
• University degree	324 (24.4)	84.9	
• Missing	6 (0.5)		
Residential area			
• City *	711 (53.5)	73.7	
• Suburb or center of a village	370 (27.8)	72.4	
• Rural	248 (18.7)	69.8	
Number of persons in the household			1.04 (0.80–1.33), 0.79 per increase of one category
• 1 person	330 (24.8)	79.7	
• 2 persons	505 (38.0)	75.6	
• 3–4 persons	352 (26.5)	68.2	
• over 4 persons	142 (10.7)	56.3	
Children in the household			
• Family with adults only *	866 (65.2)	77.4	
• Family with children	463 (34.8)	63.7	0.87 (0.56–1.34), 0.53
How often do you cook?			
• Daily or almost daily*	583 (43.9)	75.8	
• A couple of times (1–3) a week	531 (40.0)	72.1	0.94 (0.70–1.26), 0.69
• A couple of times a month or more rarely	215 (16.2)	65.1	1.30 (0.81–2.09), 0.27
Are you responsible for cooking?			
• Alone*	452 (34.0)	79.0	
• Together with other person/persons	583 (43.9)	75.6	0.86 (0.59–1.25), 0.42
• I help with cooking, but somebody else is responsible.	227 (17.1)	60.4	0.69 (0.41–1.14), 0.14
• I don't take part in cooking	67 (5.0)	44.8	0.50 (0.23–1.09), 0.08
Have you ever had food poisoning from the food you have eaten (own assessment)?			
• No *	677 (50.9)	70.8	
• Yes	505 (38)	76.8	
• Don't know	147 (11.1)	66.7	
Give yourself a Finnish school grade (4–10 best) for your knowledge and skills concerning food safety			
• Excellent (10−9)	125 (4)	81.6	
• Good (8)	723 (54.4)	76.8	
• **Average or poor (7–4)**	**481 (36.2)**	64.0	

to analyse the association of each variable with the probability of passing the test. The variables described the demographic background of the participant, the language used in the test, the test circumstances, i.e. regular or special, and the variables of the questionnaire. Multiple variable logistic regression analysis was used to analyse the independent association of each of the above-mentioned factors when the effects of all factors were included. Fisher's exact test was used to analyse the differences in the odds ratio of passing the regular test or simulated test in different gender and age groups. Statistical significance was set at $p < 0.05$.

3. Results

3.1. The performance of the participants in the official hygiene passport test and the associated factors

The overall percentage of individuals passing the official hygiene passport test was 81.7%. The percentage of those passing the regular and special tests was 89.5% and 63.3%, respectively (Table 1).

In the official tests, the probability of passing the special test was 0.2 of the probability of passing the regular test ($p < 0.00$) (Table 3). There was no significant difference in the probability of passing the regular test performed in Finnish or Swedish. In sharp contrast, there was a significant difference ($p < 0.00$) between passing the Finnish test compared to passing the special tests performed in simplified language, in English, or in other languages. The probability of passing the simplified language test was the lowest, being 0.11 of the probability of passing the Finnish test.

The percentage of women participating in the regular test was much higher than that of men (Table 1). The same difference was not seen in special test. However, the number of participants whose gender could not be concluded from the name (54.7%) was rather high in the special tests. The participants in age groups under 25 years formed 60.4% of all participants of the regular test (25.3% of those taking the special tests). The age group under 16 years, who are in compulsory education, formed 15.5% of all participants of the regular tests (1.8% of those taking the special test).

No difference was detected between men and women in the odds of passing the regular test (Table 4). In the special tests, men were less likely to pass than women ($p < 0.05$). The odds ratio of passing the regular test in the group of youngest participants (≤16 yrs) was significantly lower ($p < 0.00$) than in the group of oldest participants (56+ yrs) (OR = 0.27, 95% CI = 0.13–0.56). This difference was not seen in any other age groups for the regular test and not at all for the special tests.

The level of hygiene knowledge was slightly higher in all subsections of the approved (i.e. passed) regular tests compared with the approved special tests (Fig. 2). The order of the seven subsections of the approved and non-approved regular and approved special tests, according to the

Table 3
Association between test circumstances and language and the probability of passing the official hygiene passport test.

Variable	Single explanatory variable regression analysis OR (95% CI), *p*
Test circumstances	
• Regular test*	1.00
• Special test	0.20 (0.17–0.24), 0.000
Language of the test	
• Finnish *	1.00
• Swedish	0.82 (0.50–1.35), 0.433
• Simplified language	0.11 (0.08–0.15), 0.000
• English	0.24 (0.19–0.31), 0.000
• Other languages	0.23 (0.18–0.29), 0.000

* Reference.

Table 4
The regular and special hygiene passport tests; the association of age and gender with the probability of passing the test.

Variable	Regular test	Special test
	Single explanatory variable regression analysis	
	OR (95% CI). *p*	
Gender		
• Female *	1.00	1.00
• Male	1.06 (0.79–1.42), 0.717	0.613 (0.42–0.90), 0.01
• Unknown	0.22 (0.14–0.35), 0.000	0.585 (0.42–0.82), 0.002
Age (years)		
• ≤16	0.27 (0.13–0.56), 0.000	0.90 (0.33–2.41), 0.83
• 17–19	0.56 (0.27–1.14), 0.109	0.769 (0.39–1.50), 0.44
• 20–25	0.96 (0.44–2.06), 0.901	0.707 (0.44–1.14), 0.16
• 26–35	0.56 (0.26–1.21), 0.142	1.076 (0.71–1.64), 0.73
• 36–45	0.50 (0.23–1.09), 0.079	1.061 (0.68–1.65), 0.80
• 46–55	0.62 (0.28–1.36), 0.230	1.00
• 56+ *	1.00	

* Reference.

mean scores from highest to lowest, was: "Personal hygiene", "Cleaning", "Own or in-house control", "Hygienic working methods", "Food poisoning", "Legislation, authorities", and "Basic microbiology and food contamination" (Table 5). In the group of non-approved (i.e. failed) special tests, the only exception to the order was that the mean score for "Cleaning" was lower, i.e. the fourth highest in the order.

3.2. The performance of the participants in the simulated hygiene passport test and the associated factors

The overall percentage of individuals passing the simulated hygiene passport test was 72.6% (Table 2). The overall pass rate for the simulated test was much lower compared to the pass rate for the regular test in Finnish (89.7%). The difference in the probability of passing the simulated or regular test was significant in both genders and in all age groups, except for the age group 36–45 years. The difference was greatest in the group of young participants in the age groups 17–19 years, ≤16 years, and 20–25 years, respectively (Table 3, supplementary).

In the simulated test, the percentage of correct answers in the different subsections of approved and non-approved (i.e. passed and failed) tests was highest in "Cleaning" and "Personal hygiene" and lowest in "Food poisoning" and "Basic microbiology and food contaminations" (Table 5).

The association of passing the simulated test was tested against each of the variables of the questionnaire. When considering the significant associations, only a young age (under 19 years) and a higher level of education significantly ($p < 0.00$) predicted passing the simulated test: a young age negatively and a higher educational level positively. Gender had only a weak association with the pass rate for the simulated test ($p = 0.06$) (Table 2).

The odds ratio for passing the test was significantly higher (OR = 1.71, 95% CI = 1.40–2.10, $p < 0.00$) when the participants evaluated their food safety skills and knowledge as high. In addition, individuals who had experienced food poisoning were significantly (OR = 1.37, 95% CI = 1.05–1.79, $p < 0.05$) more likely to pass the test than those

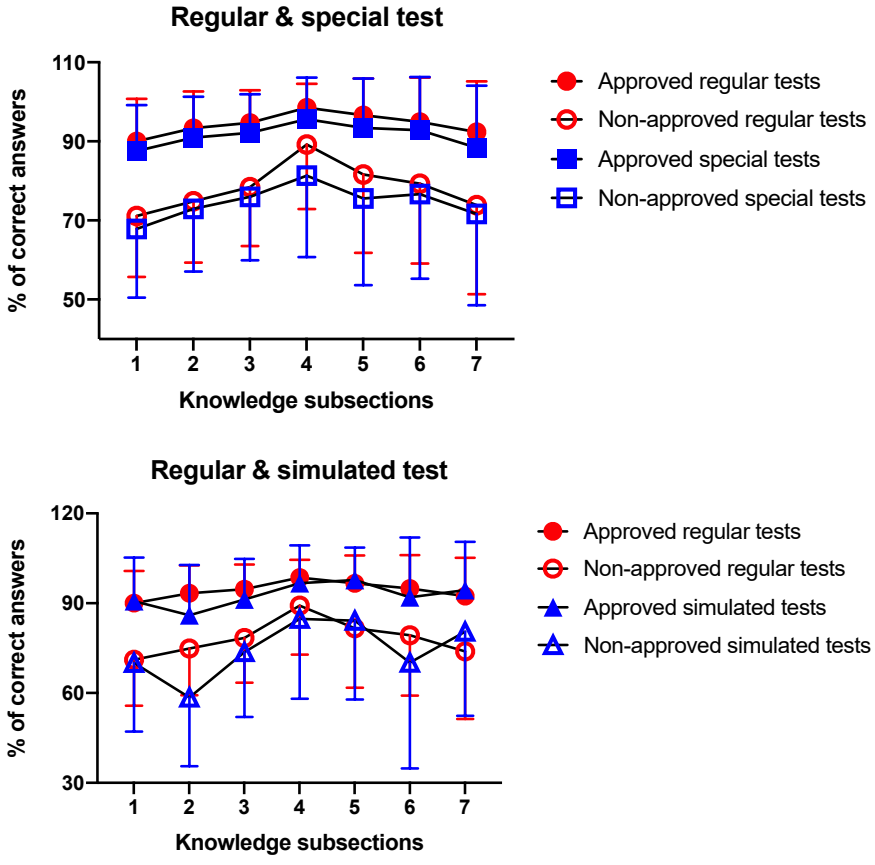

Fig. 2. The mean score and standard deviation of correct answers in different subsections of approved and non-approved regular tests and special tests (above) and in regular and simulated tests (below). Subsections: 1) Basic microbiology and food contamination, 2) Food poisonings, 3) Hygienic working methods, 4) Personal hygiene, 5) Cleaning, 6) Own or in-house control and 7) Legislation, authorities.

Table 5
The mean percentage of correct answers in the different food hygiene knowledge subsections of the regular, special, and simulated hygiene passport tests for those passing (approved) and failing (non-approved) the test.

Food hygiene knowledge subsections	Mean percentage of correct answers					
	Regular test		Special test		Simulated test	
	Approved	Non-approved	Approved	Non-approved	Approved	Non-approved
1. Basic microbiology and cross-contamination	90.0	71.1	87.6	67.9	90.8	70.0
2. Food poisonings	93.4	74.9	90.9	72.9	86.0	58.5
3. Hygienic working methods	94.7	78.4	92.2	76.0	91.3	73.8
4. Personal hygiene	98.6	89.2	95.6	81.3	96.5	85.0
5. Cleaning	96.6	81.6	93.4	75.6	98.0	84.0
6. Own or in-house control	94.9	79.3	92.8	76.7	92.0	70.0
7. Legislation, authorities	92.4	73.9	88.4	71.6	94.5	80.5

without this experience. However, by taking into account the association of other significant elements (age, education) and a nearly significant element (gender), a significant association was only observed between passing the simulated test and a high self-evaluation for food safety skills and knowledge (OR = 0.62, 95% CI = 0.50–0.78, p < 0.00).

Three food safety attitudes, "interest in learning about avoiding food poisoning", "importance of cleanliness/sanitation", and "food poisoning susceptibility", were significantly associated with passing the simulated hygiene passport test (OR = 1.46, 95% CI = 1.3–1.7, p < 0.00; OR = 2.23, 95% CI = 1.80–2.76, p < 0.00; and OR = 1.19, 95% CI = 1.05–1.35, p < 0.01, respectively). Belief in "food poisoning being a threat" or "food poisoning being a personal threat" did not have an association with passing the test. When taking into account the significant associations of age, education, and the borderline significant association of gender, an association of the three food safety attitudes, "interest in learning about avoiding food poisoning", "importance of cleanliness/sanitation", and "food poisoning susceptibility", with the pass rate of the simulated hygiene passport test was still seen (OR = 1.3, 95% CI = 1.1–1.6, p < 0.00; OR = 1.8, 95% CI = 1.4–2.3, p < 0.00; and OR = 1.2, 95% CI = 1.0–1.3, p = 0.03, respectively).

The participants had strong trust in the authorities (mean 4.4, SD 0.7, on a Likert scale of 1–4) and in FBOs (mean 4.3, SD 0.8, Likert scale 1–4). Positive responses to the questions about the participant's trust in the authorities had a significant positive relationship with the odds ratio of passing the simulated test, which decreased to a borderline effect (OR 1.2, 95% CI = 1.0–1.4, p = 0.06) when testing with other factors (age, education, gender). Trust in the FBOs of the food sector did not have a significant association with passing the simulated test.

The five different test forms made it possible to examine the association of the test itself with the pass rate. The odds ratio of passing the simulated test differed significantly in two out of five tests; the probability of passing the test was 0.5 (95% CI = 0.3–0.7, p = 0.00) at the lowest and 1.8 (95% CI = 1.2–2.8, p < 0.00) at the highest, compared with the reference simulated test form (Table 6).

Table 6
The association of the test version with the probability of passing the simulated hygiene passport test. Five separate tests differing in the test statements were used in the study, with test 1 serving as the reference in the table.

Simulated hygiene passport test	Number of participants N	Passed (%)	Single explanatory variable regression analysis OR (95% CI), *p*
1*	275	74.9	1.00
2	260	74.2	0.97 (0.65–1.42), 0.857
3	262	69.1	0.75 (0.51–1.09), 0.133
4	260	59,6	0.49 (0.34–0.72), 0.000
5	272	84.6	1.83 (1.20–2.81), 0.005
Total	1329	72.6	

* Reference.

4. Discussion

The Finnish Hygiene Passport System, a national legislative requirement, has been testing the food safety knowledge of food handlers for almost 20 years, resulting in over 1 million approved hygiene passports. However, information on the relevance of the Hygiene Passport System is virtually nonexistent. In order to fill the knowledge gaps, we evaluated performance in the official hygiene passport test according to the age and test language of the participants. In addition, to examine the level of basic food hygiene knowledge of Finns, as well as to study the effect of preparing or training prior to the official test, we organized a test simulating the official regular hygiene passport test. The present study is the first to examine performance in the Finnish hygiene passport test, and various related factors, in order to evaluate the relevance of the Finnish Hygiene Passport System.

Our study confirmed that the regular hygiene passport test is typically performed at a young age, because the hygiene passport improves the chances of getting a job in the food sector. In contrast, the participants in the special test were mostly middle-aged people speaking foreign languages, which illustrates the importance of the food sector as an employer for them.

In the official hygiene passport test, the passing score of 85% or above is higher than that set in the Canadian CIFS Food Handler Certification System (≥70%) (McIntyre et al., 2014) and higher than the limit of sufficient knowledge (>70%) used in the study of Parry-Hanson Kunadu et al., (2016). Moreover, the proportion of correct answers for all participants in the regular test was 92.1%, which is higher than reported in other studies: 73% by (Gruenfeldova et al., 2019), 70.5% by (Smigic et al., 2016) and 63.2% by (Jianu & Chiș, 2012). Hygiene knowledge tests in various studies have usually been designed individually for a certain group of participants or for a particular purpose, for example to measure improvement following an intervention, such as training. For this reason, direct comparison of the key determinants of knowledge levels in different tests is complicated or inapplicable.

Our results suggest that it is possible to pass the hygiene passport test without preparing prior to the test; approximately three out of four participants were approved (i.e. passed) in the simulated test. Participants older than 20 years, more highly educated, with a positive attitude towards food safety and confidence in their own food safety skills, and able to perform the test in Finnish or Swedish without any assistance are likely to be approved without prior preparation for the test. However, it is presumable that participants in the official test prepare prior to the test, study alone, or attend a training course. According to our results, this preparation clearly increased the level of hygiene knowledge and the pass rate, especially when the participant was aged under 20 years. This finding supports the relevance of the hygiene passport test, suggesting that without the requirement for the hygiene passport test, the level of food hygiene knowledge of new employees in the food sector, especially that of young people aged under 20, would be significantly lower.

In our study, the group of youngest participants (≤16 yrs) had more

difficulties in passing the regular test and the simulated test than the other age groups. The association between age and food safety knowledge varies; previous studies have found no association (Martins, Hogg, & Otero, 2012)or only weak association of an older age with better knowledge (Marklinder et al., 2020; McIntyre et al., 2013; Pichler et al., 2014). In our study, young people were categorized into narrower age groups than those applied in earlier studies, which allowed us to draw conclusions about the association between a young age and food hygiene knowledge. Promoting food safety knowledge in the compulsory education in Finland would likely improve the laypersons food hygiene knowledge with possible positive influence on food handling practices in food businesses and households.

The results of the simulated test arranged in our study suggest a positive association with the pass rate for the simulated test and some characteristics of the participant, which is supported also by other studies: the higher educational level (El-Nemr et al., 2019; McIntyre et al., 2013; Pichler et al., 2014), the participant's self-perceived food safety knowledge and skills (Marklinder et al., 2020) and the food safety attitudes (Baser et al., 2017; Kwol et al., 2020; Läikkö-Roto & Nevas, 2014).

The level of knowledge in seven subsections of the hygiene passport test was somewhat higher in all subsections of the regular test than in the special test or the simulated test, emphasizing the challenges facing participants in the former group and the importance of preparing prior to the test in the latter group (Table 5, Fig. 2). The subsections "Cleaning" and "Personal hygiene" were the easiest subsections of the test, while "Food poisonings" and "Basic microbiology and food contaminations" were the most difficult topics for most of the participants. In line with other studies, the participants more often answered the questions related to personal hygiene correctly than questions related to the control of time and temperature or questions related to food poisoning and food handling (Al-Kandari et al., 2019; Al-Shabib et al., 2016; Moreb et al., 2017; Pichler et al., 2014). This suggests that questions related to foodborne illnesses and food microbiology require special knowledge that may need additional attention and training when employees with an approved hygiene passport are orientated to work, especially the youngest workers.

Based on our findings, and also considering the popularity of the hygiene passport and its importance in applying for a job, the benefits of hygiene passports with different knowledge requirements should be evaluated. A hygiene passport with a focus on the essentials of food hygiene knowledge would be sufficient for employees not in charge of food safety in their work team, such as young or uneducated employees, or employees with certain special needs. In addition, a more advanced certificate for quality managers and employees in charge of the food safety management system should be considered.

The language of the hygiene passport test reflects the nationality of the participant. Based on the different languages of the test, it could be deduced that participants in the special test in our study represented various nationalities from all continents. Nationality has been reported to associate with the level of food safety knowledge of food handlers (Al-Shabib et al., 2016; McIntyre et al., 2013; Pichler et al., 2014; Woh et al., 2016). There are various possible explanations for this association, including different food safety requirements, cultural norms, and food handling practices in the country of origin, which may be some of the reasons for the lower pass rate in the special test in our study. Henley et al. (2012) also identified cultural practices that could lead to increased food safety risks for certain populations. Chinese cultural values were identified as factors affecting Chinese restaurant operation (Liu & Kwon, 2013). Cultural-dependent roles, such as preparing food for the family, may be the reason for the finding that women were more likely to pass the special test than men.

Due to the higher expenses associated with arranging the special test in a rare language, a participant may choose to take the test in some other language than the mother tongue, often English. The lower knowledge scores in the special test may thus be attributed to language difficulties of the participant, as also suggested based on the results in other studies (McIntyre et al., 2013; Pichler et al., 2014; Woh et al., 2016). Translations of the special tests, except into English and Swedish, are unofficial and are individually carried out for each test. The special vocabulary of the food industry and food safety used in the test statements is challenging to translate. Both the translator and the participant need to be acquainted with Finnish food culture to correctly understand the statements concerning Finnish traditional foods.

The results suggest the possibility that the unofficial, one-off translations of the special tests interfere with the consistent interpretation of the statements in the test, which means that participants are not treated equally in the official hygiene passport tests conducted in different languages. This risk could be eliminated by using official translations of the hygiene passport statements into various languages. In addition, visual information, such as pictures and videos, to facilitate understanding could help to overcome some of the difficulties in understanding the written statements and improve performance in the special tests. Videos, case studies, and food safety training handbooks were found to be the most preferred food safety training methods of Chinese restaurant owners/operators, and Chinese, the mother tongue, was found to be the preferred language for food safety training by Liu and Kwon (2013). Visual information would also be helpful for other participants, especially participants with special needs.

The simulated tests revealed significant differences in the pass rate between different test sets, which were supposed to be of comparable difficulty. The instrument used to measure a person's food hygiene knowledge, such as the questionnaire of the hygiene passport system, must be valid and reliable, especially when used to fulfill a legal requirement. Therefore, validation of the hygiene passport system is of utmost importance and should preferably be carried out as soon as possible.

5. Conclusions

Our study revealed that as many as 90% of the participants performing the regular hygiene passport test in Finnish or Swedish passed the exam. However, participants who performed the special test in a foreign language or with assistance had significantly more difficulties in obtaining an approved test result (i.e. a pass), which may suggest that, in addition to the level of knowledge, different cultural norms and food handling practices in the background of the participant may affect test performance. The results also suggest that the unofficial translations of the special tests might interfere with the consistent interpretation of test statements, and that participants are therefore not treated equally. We also noticed significant variation in the difficulty of the test itself, which may affect the pass rate.

Our study confirmed that although participants with certain features may pass the official hygiene passport test without prior training, preparing for the hygiene passport test increases the food hygiene knowledge of the participant and the probability of passing the test, especially in young age groups. This finding supports the relevance of the hygiene passport test, suggesting that without the requirement for the test, the level of food hygiene knowledge of new employees in the food sector, especially young people aged under 20 years, would be lower. Moreover, the questions in the test related to foodborne illnesses and food microbiology require special knowledge that may need additional attention and training when employees with an approved hygiene passport are orientated to their work.

Our study demonstrated that the Finnish Hygiene Passport System needs further research and improvement to ensure valid, reliable and fair testing of all participants. In particular, the relevance of the hygiene passport test to certain job seekers with special needs should be further studied. The conversion of the test into a digital form would enable the regular evaluation and improvement of the hygiene passport test based on accurate data collection. Questions with multiple choices and visual information might be helpful to increase consistency and facilitate

understanding.

With an approved Finnish hygiene passport, job seekers are able to demonstrate that their level of food hygiene knowledge has reached a nationally accepted level. However, turning the hygiene knowledge of an employee into consistent hygienic working skills and habits to promote food safety needs further efforts by FBOs.

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CRediT authorship contribution statement

Auli Vaarala: Conceptualization, Formal analysis, Methodology, Writing – original draft. **Liisa Uusitalo:** Formal analysis, Methodology, Writing – review & editing. **Janne Lundén:** Conceptualization, Writing – review & editing, Supervision. **Pirkko Tuominen:** Conceptualization, Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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